On the Cover

The Los Alamos Neutron Science Center (LANSCE) is a national user facility welcoming hundreds of users every year. The heart of LANSCE is the linear accelerator, or linac, which is shown stretching across a mesa top from the back cover to the front. The linac accelerates protons (a proton is the charged particle at the center of a hydrogen atom) to an energy of 800 million–electron volts. Remarkably, after 34 years of operation, it still produces one of the most intense sources of medium-energy protons in the world. The proton micropulses exiting the linac are shown entering the Proton Storage Ring (PSR), which stores and compresses the pulses, creating a much shorter and higher-intensity macropulse for research applications. When the PSR macropulses are allowed to collide with a heavy-metal target, they produce neutrons through a process called nuclear spallation. Spallation neutrons are used for fundamental research on materials and biological structures at the Lujan Neutron Scattering Center (Lujan Center). Both protons and neutrons are used for experiments at LANSCE's five major facilities.

Shown within the ring are three images that illustrate exciting new technological innovations at LANSCE's three main user facilities. At left, two scientists use the GEANIE detector at the Weapons Neutron Research Facility. That detector is one of a brilliant set of new instruments at LANSCE that measure neutron reactions on a variety of nuclei, some of which have very short half-lives. These measurements are essential for accurate prediction of the performance of a nuclear weapon and for a greater understanding of excited nuclei. At upper right, a proton radiograph shows large spikes developing in a fluid that is driven unstable by a shock wave. Proton radiography is a new technology invented at LANSCE for imaging the dynamic behavior of materials driven by high explosives. It is considered a critical tool for understanding the science of nuclear weapons, as well as investigating hydrodynamic phenomena of all kinds. The netlike structure in the image at lower right, obtained with neutron crystallography, shows the distribution of hydrogen atoms in a protein that is important to the manufacture of DNA. The new Protein Crystallography Station at the Lujan Center is one of the world's best instruments for following the transfer of hydrogen atoms in biological macromolecules because it delivers the most intense neutron flux in the world. Those transfers enable enzymes to do their work and thus hold the secrets to efficient drug design. The capability to investigate biological and other soft materials of strategic importance is likely to be further enhanced, keeping LANSCE's competitive edge well into the future.